PALEONTOLOGY—*New Ordovician echinoderms.* Harrell L. Strimple, Bartlesville, Okla., et al.

I. THREE NEW GENERA

By Harrell L. Strimple and
William T. Watkins

The latest comprehensive classification of crinoids is that of Moore and Laudon (1943). Considering their definitions of the various subclasses, one has some difficulty in determining the proper placement for one form considered below as *Anthracocrinus*, n. gen.

Under Camerata, p. 76, it is stated, "Crinoids in which all plates of the calyx are united by rigid suture are included in the Camerata." We do not believe the junction of plates in *Anthracocrinus* could be termed "by rigid suture."

Under Flexibilia, pp. 64–65, it is stated, "The Flexibilia comprise dicyclic crinoids having the lower brachials incorporated in the dorsal cup but not rigidly." Such structure is certainly typical of *Anthracocrinus*, which form, however, is not acceptable to the subclass through possession of pinnule bearing arms and five IBB. The arm of the Flexibilia are nonpinnular and there are only three IBB.

Under Inadunata, p. 21, it is stated, "The Inadunata comprises crinoids that have the plates of the calyx joined firmly together, typically by syzygial suture." If our understanding of the terms "joined firmly together" and "syzygial suture" is correct, the definition of the Inadunata requires modification. There are several known forms assigned to the subclass wherein the cup plates were held in place, at least in part, by ligaments. Dr. Moore (1939, pp. 207–208), recognized this condition when he recorded the existence of pits or depressions in the suture edges of the IBB and BB plates of *Plummericrinus mcguirei* (Moore). His explanation of these pits was: "... evidently for reception of ligament fibres." Another example may be obtained by reference to the unretouched illustration of *Allosocrinus bronaughi* Strimple (1949, pl. 4, fig. 4). The right suture edge of a radial plate is exposed therein, and shows a sharp depression in midportion that must have held ligament fibres.

The term syzygial or syzygium in crinoid terminology is usually used in reference to close union of adjacent arm segments or adjacent arms, to the point of almost obliterating the suture. As applied to cup plates, we presume the definition to mean union of cup ossicles by calcified fibers. In Pennsylvanian stratum, thousands upon thousands of isolated crinoid ossicles, as compared to the relatively few dorsal cups, amply demonstrate the absence of syzygial suture much less the firm union of plates.

The plates of *Anthracocrinus* have depressions along the suture edges as found in some inadunates and flexibles and as we presume might be found in some camerates. We are assigning the genus to the Camerata and propose Anthracocrinidae, new family, for its reception.

NOTES ON THE ARCHAEOCRINIDS

The genus *Archaeocrinus* was proposed by Wachsmuth and Springer (1881), with *Glyptocrinus lacunosus* Billings (1857) as the genotype species. The forms involved are rather well known, but some confusion still exists in interpretations of the genus over rather fundamental characteristics. In their description Wachsmuth and Springer state that two plates of the second series are present in all interradial areas with those of the posterior probably a little wider. In the genotype species, three plates follow anal X, and the same is known to occur in several other species. Wachsmuth and Springer (1885) corrected their earlier remarks, concerning the number of plates in the posterior interradius, to three plates in the second series. They gave reference to a communication from W. R. Billings wherein he advised that all the species referred to *Archaeocrinus* by Wachsmuth and Springer (1881), possess a special anal piece placed between the interradials (interbrachials) of the second (first) series. This would include *A. lacunosus* (Billings), *A. marginatus* (Billings), *A. microbasilis* (Billings), and *A. pyriformis* (Billings). One assumes that Billings had material to support such an observation for all the species involved.

It has been noted that a median-ray ridge marks the brachials in the cup and may pass on to the radial plates. The base of the dorsal cup is concave and the infrabasals are confined to the basal concavity with the notable exception of the form originally described as *Thysanocrinus pyriformis* Billings (1857).

In an effort to resolve the status of *T. pyriformis*, the senior author requested Dr. Alice E. Wilson, Geological Survey of Canada (retired), to examine the holotype of the species. She was kind enough to do so, and also to provide a photograph of the specimen, which is numbered 1446b. The proximal portion of the BB are curved slightly inwardly, which has not been shown by Billings or by Wachsmuth and Springer in their illustrations. The specimen figured by Wachsmuth and Springer (1897, pl. 10, fig. 3b), is 1446b; however, it is considerably brightened up and they do not note that it is the holotype. The specimen figured by those authors (pl. 10, fig. 3a), as "the type specimen" is numbered 1446c, and is a paratype. Both specimens demonstrate upflared infrabasal plates that are readily visible in side view of the dorsal cup; therefore, the species is not a bona fide representative of the genus *Archaeocrinus*. This is of particular interest because Moore and Laudon (1943, text-fig. 13), have obviously used the paratype of *Thysanocrinus pyriformis* as the basis for their diagram of the genus *Archaeocrinus*, the type of the family *Archaeocrinidae* Moore and Laudon.

It has been amply demonstrated elsewhere that forms with decidedly upflared IBB are either primitive, or have advanced through stages wherein the base has become concave, with IBB restricted to the concavity, and thence to a stage where the IBB are again upflared. A long evolutionary process could hardly have transpired in these primitive forms and therefore *T. pyriformis* must be considered to be more primitive than *Archaeocrinus*. We consider it desirable to remove the species from *Archaeocrinus*, and since no other genus is suitable for its reception we propose it as the genotype of *Neoarchaeocrinus*, n. gen. On the basis of the existence of upflared IBB, we refer *Archaeocrinus obconicus* Slocum (1924) to *Neoarchaeocrinus*.

We have yet another form to be considered wherein the dorsal cup has the general appearance of *Archaeocrinus*, as restricted, but does not have the characteristic arrangement of plates in the interradius areas. As discussed above, there are two plates in the second series of the interradius areas in all except the posterior interradius, which typically has three. There is at hand a distinctive species from the Bromide of Oklahoma, which has three plates in the second series of all interradius areas with the exception of the posterior which may have either two or three plates in the second series (first interbrachial series). For this form we propose the name *Pararchaeocrinus decoratus*, n. sp., genotype of *Pararchaeocrinus*, n. gen.

Subclass Camerata Wachsmuth and Springer

Anthracocrinidae Strimple and Watkins, n. fam.

Dicyclic; cup high; IBB small, elongate, projecting far into the body cavity; RR separated all around; median rays prominent; IBrBr regular, mildly depressed; anal area small, though broader than other interradial areas, median ray absent; proximal brachials and pinnules (ramules?) incorporated into the cup though not always in complete contact; suture edges have depressions, apparently for reception of ligament fibres; lumen large, pentalobate; arms uniserial; tegmen unknown. Range—Ordovician, North America.

Anthracocrinus Strimple and Watkins, n. gen.

The definition of family given above is of course also applicable to the genus. It is noted here that the first interradial plates, including anal X, are in full contact with the basal plates. The bifurcation of arms is significant, $PBrBr_2$ are axillary in all rays and a second branching is present in some half rays, but never in both primary divisions of any one ray. The arms and pinnules do not become free before the second bifurcation.

The most nearly comparable form known to us is *Deocrinus* Hudson (1907). It is readily separable from *Anthracocrinus* in that it does not have a median ridge over the brachials; the large interradial plates are separated from the basals, adjacent radials, and brachials by a series of small plates; and the lumen is round. The meeting of first pinnules of each arm over the interbrachials and the structure of the pinnules and

brachials are remarkably similar for the two genera.

Genotype species.—*Anthracocrinus primitivus* Strimple and Watkins, n. sp.

Anthracocrinus primitivus Strimple and Watkins, n. sp.

Figs. 1a–c, 2a, 4–6

Dorsal cup high with very deep basal concavity. Five elongate IBB and more than half the length of the five BB form a tubular chamber extending far into the body cavity. The proximal columnals are usually in place so that it is necessary to examine this structure from within the cup. A sharp ridge on the BB forms a pentagonal rim about the invaginated base. Five RR are moderately large, pentagonal plates. Five large interradials are in full contact with BB below, RR and BrBr to the lateral sides and with two small interbrachials above. The posterior IR (anal X) is smaller than other interradials and the succeeding plates are larger than found in the other four interrays.

There are typically 3 arms to a ray. First bifurcation takes place with $PBrBr_2$ in all rays. Second bifurcation is usually found on $SBrBr_2$ but in one observed instance occurred on SBr_1. Only one-half ray in any one arm will branch more than once. Usually the second brachial above the second bifurcation in a ray will bear a pinnule. In some instances, dependent upon the presence or absence of IBrBr plates, the third or fourth succeeding brachial bears a pinnule, and the next brachial. The succeeding brachial will normally be nonpinnular, and the next brachial will have a pinnule on the side opposite the first pinnule. Succeeding brachials have one pinnule on opposite sides. The first few plates of the lower pinnules are very large and meet over the two plates of the interrays. There is a loose union between lower segments of the pinnules and brachials that in effect make them part of the dorsal cup and would certainly have prevented any pronounced movement of these elements.

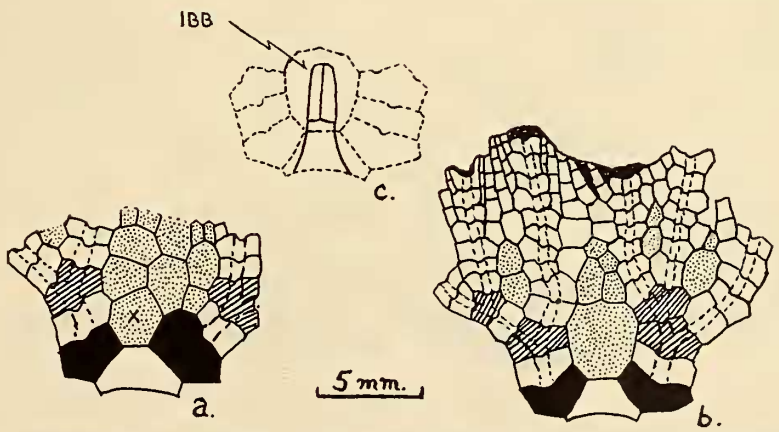
The proximal portion of the stem is large and composed of alternatingly expanded, round segments which do not appear to bear cirri. Very wide, relatively thick columnals are followed by very thin, narrow columnals. Small nodes girdle the mid-section of the thicker columnals. The lumen is large, pentalobate in outline.

The tegmen has not been observed.

Measurements.—As follows:

	Holotype
Width of cup at $PBrBr_2$	10.5 mm.
Height of cup at $PBrBr_2$	3.5 mm
Width of basal cavity	3.2 mm.

Discussion.—This form was discovered by the junior author several years ago at the Spring Creek exposure in the Criner Hills that has also produced *Myeinocystites natus* Strimple (1953a) *Archaeocrinus subovalis* Strimple (1953b) and numerous other unusual forms. Subsequent field work by Allen Graffham and the authors has provided enough material to compile the description given above. One of the main difficulties encountered at the onset was the determination of the nature of and the plates contained in the basal invagination. This difficulty was surmounted when Mr. Graffham stripped off the side of a crown. This is shown in Fig. 1c.



Figs. 1*a–c*.—*Anthracocrinus primitivus*, n. sp.: Diagrammatic drawings showing (*a*) the posterior interradius, (*b*) normal interradius, and (*c*) placement of infrabasal plates high in the dorsal cup.

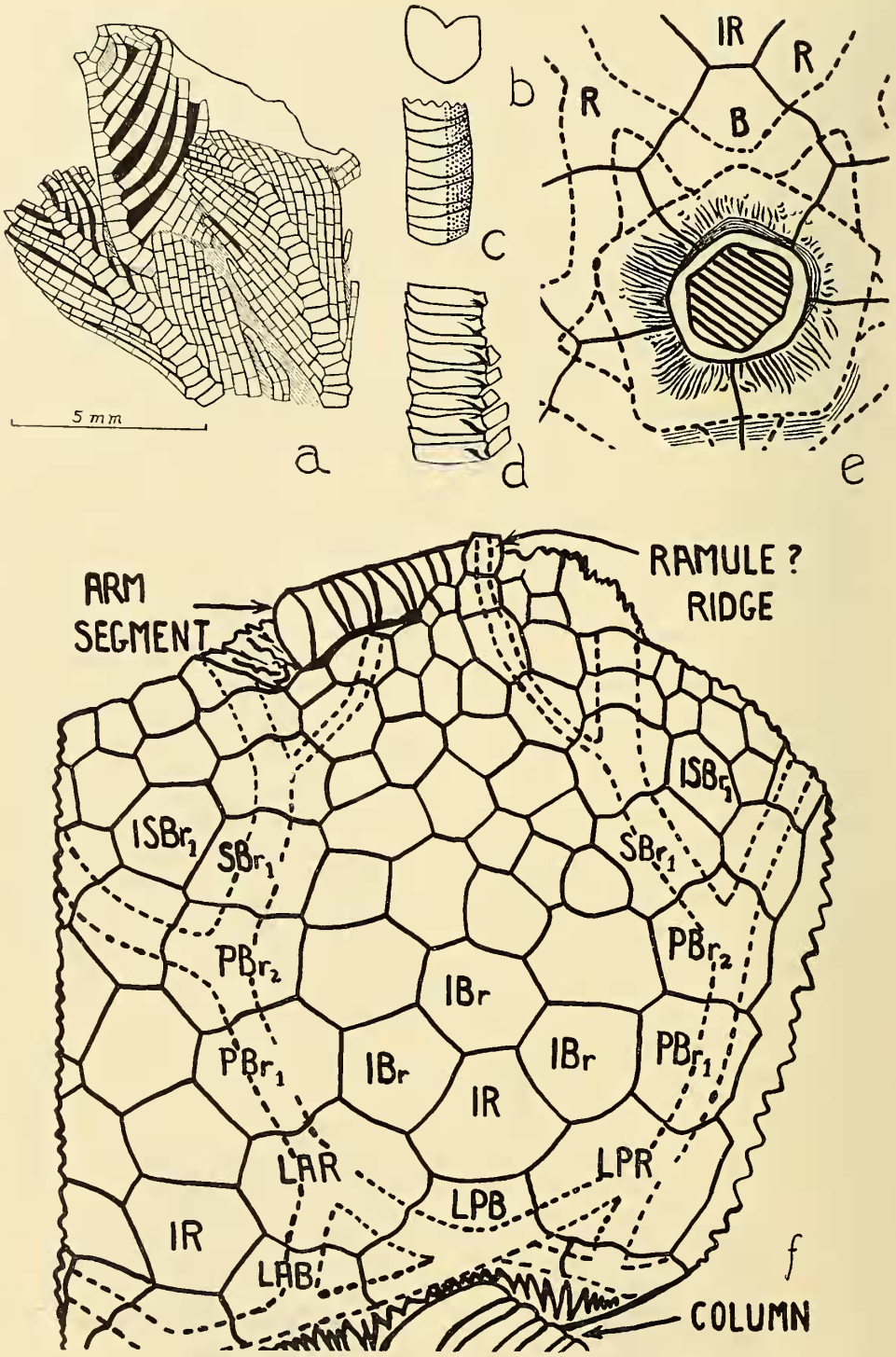


FIG. 2*a*.—*Anthracocrinus primitivus*, n. sp.: Camera-lucida drawing of arms near their termination. FIGS. 2*b–f*.—*Pararchaeocrinus decoratus*, n. sp.: Camera-lucida drawings showing (*b*) a cross section of a brachial plate; (*c*) tegment of arm; (*d*) segment of arm in side view to show pinnular attachment; (*e*) base of cup showing strong crenulation on basal plates and the proximal columnal in place at the bottom of the basal concavity; and (*f*) side view of dorsal cup showing normal interradius and ray ridges (marked by broken lines).

Anthracocrinus primitivus is considerably smaller than associated *Archaeocrinus* and *Pararchaeocrinus*. Specimens are consistently black in color when first found. Washing and brushing will in some instances remove the black coloring. Under mild magnification the plates of the crown are very porous, and it is our thought that a thin skinlike membraneous or leathery covering might have existed in life that is preserved as a black pigment.

The only described species that appears to be closely similar to *Anthracocrinus primitivus* is *Deocrinus asperatus* (Billings) and readily apparent differences have already been given under the comparison of the two genera.

Occurrence.—Lower Bromide formation, Ordovician; east bank of Spring Creek, a tributary of Hickory Creek, Criner Hills, southeast of Ardmore, Okla.

Types.—Holotype and four paratypes to be deposited in the U. S. National Museum.

Family ARCHAEOCRINIDAE Moore and Laudon, 1943

Neoarchaeocrinus Strimple and Watkins, n. gen.

Dorsal cup rather elongated, obconical in shape. Five IBB upflared and readily visible in side view of cup. Five large RR separated all around. Five large BB. Five IR, regular one in each interray with that of the posterior designated as anal X. Two $IBrBr_1$ in all interrays except the posterior which has three, designated as anal plates. Faint median ridges mark the brachials that are incorporated into the dorsal cup for a considerable distance. Arms are cuneiform and relatively small, especially when compared to the size of the dorsal cup.

An excellent diagram of *Neoarchaeocrinus* is given by Moore and Laudon (1943, text-fig. 13) as representative of *Archaeocrinus*. It seems likely that *Neoarchaeocrinus* evolved directly out of the Reteocrinidae. It is closely related to and may be directly ancestrial to *Archaeocrinus* from which it differs in having a more primitive (erect) base.

Genotype species.—*Thysanocrinus pyriformis* Billings.

Range.—Ordovician to lower Silurian.

Pararchaeocrinus Strimple and Watkins, n. gen.

Dorsal cup rather short, subglobular shaped. Five IBB confined to basal concavity. Five large RR separated all around. Five large BB. Each B is followed by a single IR which is in turn followed by three IBrBr with the exception of posterior B. In the posterior interradius there may be two or three anal plates in direct contact with post. B. The posterior interradius is protruded. Each R is followed by a single PBr which is in turn followed by an axillary PBr_2. A small series of IBrBr occur after the bifurcation of the fixed brachials, usually in the arrangement 1–2–3. Strong median ridges mark the brachials. The BB are joined by a confluent ridge that forms a pentagon about the basal concavity. A division of this ridge passes from each B to the adjoining RR so that a stellate shape is formed at their junction at midsection of the RR from whence they join with the ridge marking the brachial plates.

This genus is closely related to *Archaeocrinus* from which it differs mainly in the structure of the plates of the interrays as has been discussed above.

Genotype species.—*Pararchaeocrinus decoratus* Strimple and Watkins, n. sp.

Range.—Ordovician, North America.

Pararchaeocrinus decoratus Strimple and Watkins, n. sp.

Dorsal cup globular, with small basal concavity formed by the proximal edges of the five BB. Five IBB are confined to the base of the concavity. Proximal columnals entirely fill the basal concavity and thereby cover the IBB. Each B is in contact with seven plates with the exception of posterior B, and have raised ridges that pass to adjacent BB forming a pentagonal shaped rim about the basal concavity. Divergent ridges also pass from each B to adjoining RR and converge in midsection of each R thus forming a stellate shaped rim in the lower part of the cup. Post. B is larger and more elongate than other BB and has 8 or 9 facets. A large IR follows each B and is in turn followed by three plates in the second series (IBrBr), except in the posterior interradius. The proximal portion of the posterior interradius is narrower than other interrays, which is partially compensated for through strong protrusion of the cup in this area. The exact number of plates varies, as well as the arrangement of the plates. In the holotype, post. B is followed directly above by a single anal plate (anal X?),

to the right by another anal, and to the right side by yet another anal plate. In the figured paratype, post. B is followed directly above by a single anal plate (anal X?) and to the right side by another anal plate. The only difference in these two specimens is the existence of an extra anal piece above the right anal plate in the holotype that is absent in the figured paratype. The anal plate to the right is followed to the right above by a plate bearing a strong ridge that originates on the right posterior R. The plate is situated too low to be considered in the third series yet is not, sensu stricto, part of the second series. It is followed by a series of hexagonal plates that divide the posterior interray into two parts and carries the raised ridge to the distal termination of the cup. From study of existing material it is difficult to visualize the purpose of this ridge, and series of plates, because the pressure of the gut is apparent in the left portion of the interradius; however, as the raised ridge curves slightly to the left, and the pressure of the gut veers slightly to the right, they become confluent at about midlength of the ridge.

The arms become free on or about the fourth secundibrach and thereafter are narrow, elongated, cuneiform, and bifurcate isotomously at least twice. Each brachial is thin and carries a very thin, extremely elongated pinnule on its thickest lateral side. A special pocketlike arrangement for the reception of the pinnule is shown by text-fig. 2d. Owing to the thinness of the brachial plates, the pinnules are closely spaced. Axillary brachials in the free arms are small and triangular shaped.

The RR are normally seven sided and are followed directly above by six sided, non-axillary first brachials. First bifurcation of rays is with the second pribibrachials, which plates are five sided. The arrangement of intersecundibrachials is 1–2–3.

A significant division of the raised ray ridges takes place with the $SBrBr_2$ wherein a thin ridge passes onto adjoining interbrachials of the large interradius area, and continues to the upper extremity of the cup. There are thus two of these ridges to each interray that continue to the upper edge of the cup where they are only one plate apart. Such a ridge could serve a pinnule and in fact these plates are of course fixed pinnules, but one would expect a ridge on each succeeding fixed pinnule which is not the case. It is more likely that the ridge marks a ramule.

All plates are marked with fine ridges that radiate from the center of each plate and are usually conjunct with those of adjoining ridges. Unusually heavy and erratically shaped, short ridges are found in conjunction with the raised arm rays in the upper portion of the cup.

Proximal columnals are thin, broad ossicles. They are mildly pentagonal in outline and are alternatingly expanded. Text-fig. 2e, shows the proximal columnal in place and the nature of the large lumen. Heavy crenulations are present in the walls of the basal concavity and pass onto the flattened base as illustrated by Fig. 2e, and demonstrates the reason all proximal columnals are usually in place. This arrangement is no doubt matched by similar ridges and depressions on the outer edges of the proximal columnals. The column is rather small considering the size of the crown and the form probably devised this interlocking arrangement to prevent the shock of sudden movement from breaking the crown loose at its proximal extremity where the newer columnals are present. As the columnals became more mature their interlocking crenulations between segments probably sufficed to hold them together.

Measurements.—As follows:

	Holotype, mm.	*Figured paratype, mm.*	*Paratype, mm.*
Width of dorsal cup (approx.)	28.2	22.4	20.0
Height of dorsal cup (approx.)	19.6	15.7	16.0
Width of basal concavity	4.0		4.0
Width of proximal columnals	4.0		4.0
Length of free arms as preserved			39.5

Remarks.—This form was discovered by the junior author several years ago at the Spring Creek exposure of the Bromide formation in the Criner Hills of southern Oklahoma. A colony was excavated by the authors on an expedition to the outcrop in 1948. All specimens were firmly embedded on the underside of slabs and presented a serious problem of preparation for adequate observation. Fortunately another small colony was discovered by Allen Graffham and the senior author several feet from the original colony where the zone approached the surface and the matrix was somewhat disintegrated. Two specimens from the later colony are figured as the holotype and a paratype, and several complete crowns from the first colony are designated as paratypes. One specimen from the Hickory Creek exposure (Rock Crossing) of the Bromide formation, showing the crenulations of the basal concavity and the proximal columnal in place (Fig. 2e), is designated as a paratype.

The relatively common species described as *Archaeocrinus subovalis* Strimple seldom occurs in the same zone with *Pararchaeocrinus decoratus*. One specimen of the former was found on the edge of a slab from the original colony of the latter where the colony was pinching out. Conversely, one specimen of *Pararchaeocrinus decoratus* was found in the large colony of *Archaeocrinus subovalis* that was excavated by us. The next lower zone, and higher zones, carry *Archaeocrinus subovalis* is profusion. The two forms are readily separable on the basis of the arrangement of plates in the interradius areas and due to the unornamented surface of *A. subovalis*.

Types.—Figured holotype, paratype and numerous paratypes are to be deposited in the U. S. National Museum. One slab with several paratypes exposed is to be deposited in the collections of the University of Oklahoma.

REFERENCES

All cited references may be found in Bassler and Moodey, *Bibliographic and Faunal Index of Paleozoic Pelmatozoan Echinoderms*. Geol. Soc. Amer. Spec. Pap. 45, 1943, with the following exceptions:

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Strimple, Harrell L. Bull. Amer. Pal. Soc. **32**: 265–270, pl. 36, fig. 4. 1949.

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II. A NEW SPECIES OF CYATHOCYSTIS

By Harrell L. Strimple and
A. Allen Graffham

The discovery of a representative of the rare genus *Cyathocystis* Schmidt (1879) in the lower Bromide formation (Ordovician) of Oklahoma by the junior author warrants considerable attention. Only three species of this edrioasteroid are known. They are *C. plautinae* Schmidt (1880), the genotype, *C. rhizophora* Schmidt (1880), and *C. americanus* Bassler (1936). The first two species are from the Ordovician of Estonia, the later from the Ordovician of Tennessee. The Oklahoma species is described below as *C. oklahomae*, n. sp.

Family Cyathocystidae Bather, 1900

Genus **Cyathocystis** Schmidt, 1880

Cyathocystis oklahomae Strimple and Graffham, n. sp.

Figs. 3, 7, 8

Four specimens of the species are available for study, the larger and most perfectly preserved specimen is taken as the holotype. One paratype is perfectly preserved except for the covering plates of the anal opening which are missing in this specimen. The holotype has fine ridges marking the ambulacrals and interambulacrals, and the center sutures between the interlocking ambulacral plates are marked by a well-defined ridge. The smaller specimen does not show this ornamentation so well. There is also evidence of division of the large plates covering the mouth in the holotype that has not been observed in the smaller paratype.

Upper ambulacral surface is bordered by a subpentagonal frame of 31 marginals, excluding the 5 small plates that border the anus. Interambulacrals are five solid plates that are much wider than long. Ambulacra are broad, straight rays with a single series of interlocking covering plates. Five large plates cover the mouth. The anus is situated between a deltoid and the marginal frame, and is covered by a mosaic of small, irregular plates. There is a small shelf on the deltoid bordering the inner edge of the anus.

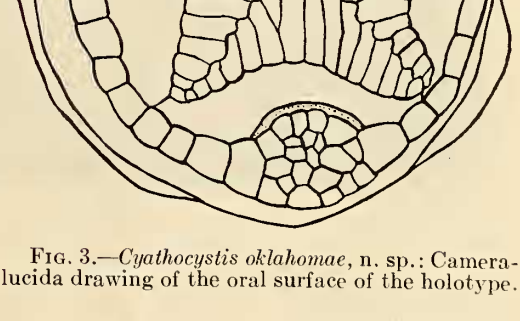

Fig. 3.—*Cyathocystis oklahomae*, n. sp.: Camera-lucida drawing of the oral surface of the holotype.

Aboral portion of the theca is a fused mass of stereom with no visible longitudinal sutures. An encrusting root type of base indicates permanent attachment to a foreign object.

Measurements.—As follows:

	Holotype
Width of theca	7.0 mm.
Height of theca	5.5 mm.
Length of ambulacra	2.8 mm.
Width of deltoid	3.1 mm.
Length of deltoid	0.9 mm.
Greatest width of anus[1]	1.5 mm.

[1] Excluding five plates in line with the marginal plates.

Remarks.—In the genus *Cyathocystis*, the interambulacrals are fused to form five large plates designated as deltoids. The aboral portion of the theca is also fused; however, European species are reported to sometimes disclose obscure longitudinal sutures, irregular in number and position, but never more than five. The anus has five covering plates. There are 40 marginals forming the pentagonal frame bordering the upper ambulacral surface.

C. americanus differs from the European species in having more narrow and elongated ambulacra. The covering plates of the anus are not pre-

FIGS. 4-6.—*Anthracocrinus primitivus*, n. sp.: Unretouched photographs of crowns in side view; 4, A paratype, × 2; 5, the holotype, × 3; a paratype, × 2. FIGS. 7, 8.—*Cyathocystis oklahomae*, n. sp.: Unretouched photographs of the holotype, × 5.3; oral view of theca with anus to the right; side view of theca with anus to the left. FIGS. 9, 10.—*Pararchaeocrinus decoratus*, n. sp.: Side view of a paratype, × 3; the holotype viewed from below, × 2.

served in the holotype, and only known specimen, though the opening is present according to a communication received by the senior author from Dr. Bassler. The deltoids are rather elongated and there appears to be about 40 marginal plates. The theca is elongated and is subpentagonal in outline according to the description of the form. *C. oklahomae* differs from *C. americanus* in having a short, rounded theca, short deltoids, short broad ambulacra, and a reduced number of marginal plates.

C. oklahomae differs from European species in having elongated ambulacral covering plates, reduced number of marginals, shorter deltoids and more than five covering plates for the anus.

Occurrence.—Lower Bromide formation, Ordovician; exposure in the east bank of Spring Creek a tributary of Hickory Creek, Criner Hills, some 7 miles southwest of Ardmore, Okla.

Types.—Holotype and one paratype to be deposited in the U. S. National Museum.

REFERENCES

All references are listed in Bassler and Moodey, *Bibliographic and faunal index of Paleozoic Pelmatozoan* echinoderms, Geol. Soc. Amer. Spec. Pap. 45, p. 199. 1943.

ENTOMOLOGY.—*Three new species of* Culicoides *from Texas (Diptera: Heleidae).*

WILLIS W. WIRTH, Entomology Research Branch, U. S. Department of Agriculture.

(Received July 12, 1955)

In early 1953 it was definitely established that the virus disease of sheep known as bluetongue is present and is occasionally epizootic in the southwestern United States. In South Africa, where bluetongue has caused severe losses to sheep raisers and has been studied intensively for several decades, the only proved vectors are biting midges of the genus *Culicoides*. Drs. D. A. Price and W. T. Hardy, veterinarians of the Texas Agricultural Experiment Station at Sonora, have produced bluetongue infections in sheep experimentally by injections of macerated *Culicoides variipennis* (Coquillett) caught in a light trap on the station where an outbreak of the disease was in course (Journ. Amer. Vet. Med. Assoc. **124:** 255–258. 1954).

In preparation for anticipated further studies on the epidemiology of bluetongue in America, including the determination of the vector species and studies on their biology and control, a survey was begun in May 1953 to determine the distribution of the species of *Culicoides* in the bluetongue area of Texas. Descriptions of three new species taken on the surveys are presented here, in order to make their names available to other workers. The types are deposited in the U. S. National Museum in Washington.

I am greatly indebted to the personnel of the Kerrville laboratory of the Agricultural Research Service for their assistance in the survey.

Culicoides neopulicaris, n.sp.

Fig. 1

♀. Length 1.25 mm, wing 1.13 by 0.5 mm.

Head dark brown, eyes contiguous, bare. Antennae with flagellar segments in proportion of 20:18:18:18:18:18:18:18:20:22:25:28:45, distal sensory tufts on segments 3, 11–15. Palpal segments (Fig. 1, b) in proportion of 10:22:34:13:10 third segment moderately swollen in middle with numerous spoon-shaped sensillae borne on extensive concavity distal to middle of segment.

Mesonotum dark brown, the dorsal surface with yellowish gray pruinosity, with more or less of an indication of a broad median paler gray band from humeral pits to prescutellar sensory depression, the long hairs mixed yellowish and dark brown. Scutellum dark brown, with four strong blackish bristles; pleura very dark brown. Legs uniformly dark brown, becoming somewhat paler on tarsi; hind tibial comb of six long subequal bristles.

Wing (Fig. 1, a) with anterior radial cells complete; costa 0.6 as long as wing. Macrotrichia fairly numerous on distal half of wing and in cell M4 and anal cell. Wing predominantly whitish, the dark markings quite limited, forming essentially three broken transverse bands of spots as figured. The first dark costal spot halfway between wing base and crossvein r-m and extending from costa only across base of media; second costal spot covering distal half of first radial cell, not extending into cell R5; third costal spot just past apex of costa, hourglass-shaped, the